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ABSTRACTS & POSTER ABSTRACTS

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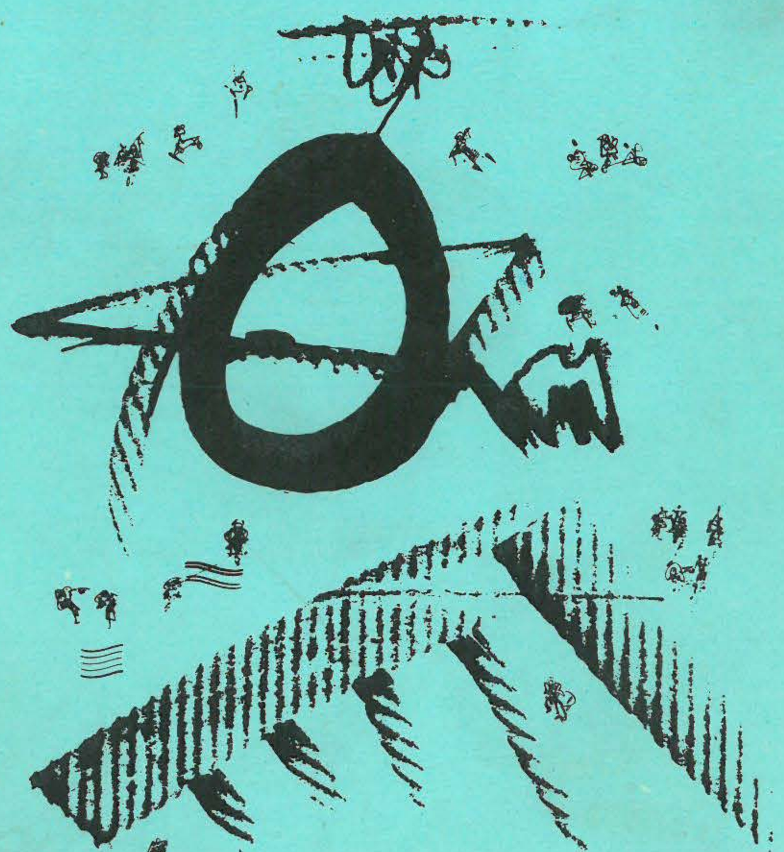

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MIDDLE MIOCENE PALEOKARST IN THE MADRID BASIN (SPAIN). A COMPLEX KARSTIC SYSTEM.

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A broadly developed paleokarst has been recognized within neogene deposits of the Tertiary sedimentary sequence in the northwestern side of the Madrid Basin (centre of Spain).Previous references about this paleokarst may be found in CALVO et al (1980), who analysed it in an area nearly Guadalajara, and MEGIAS et al (1983). The results obtained in this paper lead to conclude that the paleokarst is much more extended in the basin than previously referred. Outcrops where paleokarstic features have been observed locate in points so distant (Fig. 1) as Arganda (A), Campo Real (C.R.), Rivas-Vaciamadrid (R.V.), Morata de Tajuña (M.T.), Pezuela de las Torres (P.T.), Villarejo dc Salvanés (V.S.) and somewhere else.

Paleokarstification affected to the uppermost part of the Intermediate Unit of the Miocene (middle to upper Aragonian (ALBERDI et al, 1983; CALVO el al, 1984). Along the studied area this unit consists of a 40 - 60 m thick sequence of alternative carbonate and lutite beds. When they are not karstified, withe to cream carbonate beds display a tabular geometry and they are mainly composed by dolomite or high magnesium calcite. Texture is made up by micrite or microsparite aggregates with scarce ostracod and charophyte sections, only disrupted by casts of lenticular gypsum. Greenish to grey lutites are composed by Mg-smectites with minor illite and micas. Overlying formations (Upper Unit of the Miocene, ALBERDI et al. o.c.) consist of coarse clastics and paludine to lacustrine limestones also capped by more recent paleokarstic surfaces (PEREZ GONZALEZ, 1981).

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A detailed analysis of the paleokarst features has been achieved in two neighbouring sections near Campo Real. Section close to this village shows the upper miocene clastics (arcosic conglomerates) overlying a deeply karstified carbonate sequence. Karst features are followed through down about 40 m. Karstification had to a complete transformation of the substrata which appears as a monotonous sequence of nodular, "boudin" -like limestone beds with interstitial deformed lutites (Nodular-Breccia Facies). Included lutites are composed by pure sepiolite with some carbonate nodules The highly transformed limestones commonly exhibit mesocrystalline mosaics with crystals displaying a radial internal structure as well as aggraded micrites with porphydotopic cement crystals (F.5 and F.2 fabrics of CALVO et al, 1980). Only small relicts of calcite with lenticular gypsum moulds are observed. Dissolution forms (solution pipes and fissures) and associated collapses are mainly located in the uppermost part of the sequence. Drusy fills are poorly developed.

In constrast, another section observed in a little quarry, 6 Kms far to the south-west, show a completely different rock sequence. Herein, carbonate and lutite beds of the Intermediate Unit are strongly karstified in a definite level exhibiting well developed constructive karstic forms (Flowstone Facies), but this level is in his turn overlain by deposits of the same Unit where the karstic features are absent. The karst profil is about 6 m thick. Initial cavities or hollows had elongate shapes and they arranged coincident to the primary stratification, although in some cases they cut it, leading to a network of interconnected irregular voids. Maximum height observed in the cavities reaches up 50 cm. The cavities always show sinuous or rough walls. These morphologies are interpreted as a result of an incipient karstification stage in which initial formation of cavities was not generated by common karstic solution but mainly by enlargement of bulk porosity due to lithification phenomena. Diagenetic changes occurred in the primary deposits involved transformation of dolomicrite and HMC into LMC sparry mosaics with crystal sizes ranging 15-300 μ (average crystal sizes 60-150 μ). Biggest crystals correspon to mosaics with single crystals displaying internal radial structure (F.5).

Later circulation of water through less lithificated, more porous zones of the rock would provide subsequent enlargement of previous pores and it contributed to smooth the void walls. Chemical deposition in the karstic voids may be grouped in three types: a) banded microcrystalline calcite, that reminds pop-corn fabrics. Laminae were precipitated in a subaerial cave environment througout wet and dry alternative periods; b) Aligned rafts of mesocristalline calcite. They seem the fossil floating calcite described by POMAR et al (1976). We interpret it as phreatic sediments in small gours; c) Drusy fills, where two different types may be recognized: LMC tooth-shaped crystals and coconut-meat calcite. The former are the most abundant and they constitute the last filling stage of the void. Crystal habit is idiomorphic with c-axis growing perpendicular to the walls. Cristal size reaches up a few cms. Coconut-meat calcite forms fills less than 1 mm thick, growth-layers in these crystals are defined by impurities.

Physico-chemical considerations: A conceptual physicochemical model may be stablished to explain the genesis of the porosity from parent material (mainly loose dolomicrite and HMC-micrite) to speleothems and karst related materials. In the lithiphication processes incongruent solution is the dominant reaction, because the formation water is slowly fluxed by meteoric infiltrational waters, with a high ratio Ca^{2+}/Mg^{2+}, and near to saturation. A porosity (α) coeficient may be defined, and the incongruent solution reactions in an open flow water system lead to a secondary porosity (Ps), may be writte as:

$Ps = Pp + (1-Pp)$ Pp is primary porosity.

The α value in incongruent solution of HMC is nearly 0,10 and in the dolomicrite materials is 0,42. This increase of porosity related with lithification processes lead a progresive increase of transmissibility and a disminution of degree of saturation of meteoric infiltrational waters. Therefore, congruent solutions reactions are the dominant process.

Concluding Remarks: Two kinds of karstic morphologies have been distinguished in a central area of the Madrid Basin. They can be related to two different, probably coeval, genetic karst models. A first type refers to telogenetic (solution and constructive processes) features, which are observed in the upper part of the Intermediate Unit (Campo Real section). This type might be ascribed to an uncovered karst system that was later partially eroded and "fossilized" by fluvial and lacustrine deposits. Main characteristics of this karst are the development of floor and wall speleothems as well as autoctonous detrital deposition into the cavities.

The second type, analysed in a lower stratigraphic position, may be interpreted as an interstratal karst system developed in a partially confined acuifer system. Lateral water flow mainly developed elongate-shaped cavities that were filled with several types of cave sediments. Detrital deposits are absolutaly absent in these cavities.

Recharge mechanisms, as well as its geographical and geological distribution in the Basin are not well-Known. The stratigraphic implications of the paleokarst are, in any case, undoubtful but care must be take having in mind the conclusions that can be outlined from the different types (uncovered and interstratal) of paleokarst morphology that we have described.